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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aide in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

FINAL REPORT

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TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATT.

FOR

SPINNER, RING FRAME .682.885

S-53

TM 001 250

U. S. Employment Service in
Cooperation with
Tennessee State Employment Service

U. S. DEPARTMENT OF LABOR

Washington , D. C.
June 1954

GATB #2020
Fall 1953

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY
FOR
SPINNER, RING FRAME 682.885

S-53

Summary

The General Aptitude Test Battery, B-1002A, was administered to a sample of 45 women employed as Spinner, Ring Frame at the Dixie Mercerizing Company, Chattanooga, Tennessee and to a sample of 15 women employed as Spinner, Ring Frame at the Hyde Park Mills, Covington, Tennessee. The two samples were combined making a total sample of 60 women. The criterion used for each sample consisted of rank order supervisory ratings. On the basis of mean scores, standard deviations, correlations with the criterion and job analysis data, Aptitudes P-Form Perception, K-Motor Coordination, F-Finger Dexterity, and M-Manual Dexterity were selected for inclusion in the test norms.

GATB Norms for Spinner, Ring Frame 682.885 - S-53

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Spinner, Ring Frame 6-19.041.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002
for Spinner, Ring Frame - 682.885

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
P	CB-1-A CB-1-L	70	P	Part 5 Part 7	70
T	CB-1-G CB-1-K	75	K	Part 8	80
F	CB-1-O CB-1-P	80	F	Part 11 Part 12	75
M	CB-1-M CB-1-N	90	M	Part 9 Part 10	85

Effectiveness of Norms

The data in Table IV indicate that 11 of the 20 poor workers, or 55% of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 55% of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 31 of the 40 workers who made qualifying test scores, or 78% of them, were good workers.

TECHNICAL REPORT

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Spinner, Ring Frame 682.885.

II. Sample

The GATB, B-1002A, was administered during March and August 1953 to a sample of 60 women employed as Spinner, Ring Frame. Forty-five of the women were employed at the Dixie Mercerizing Company, Chattanooga, Tennessee. They were selected from a group of 125 names which represented all the Ring Spinners at this company. Out of this group, 100 women, who represented the first and second shift crews, were selected. These names were arranged in alphabetical order and then, where possible, every other name was selected to make a total of 50 women. Only 47 of these women reported, and two of that number were eliminated because of their inability to cope with paper-and-pencil tests, which left a sample of 45 in this group. The remaining 15 women were employed at the Hyde Park Mills, Covington, Tennessee. Here the sample was selected from personnel who had varying degrees of job performance and a willingness to participate in the program.

On the job training is given at both plants. At the Dixie Mercerizing Company, the training period lasts approximately 6 months. By this time the Spinner is tending an assigned number of machines. At the Hyde Park Mills, there is an organized training plan under a trained instructor for a period of 8 weeks.

Since the job duties, performance level, and criterion data as well as the age and education characteristics of the two groups were found to be quite similar, they were combined to make one sample of 60 women engaged in the occupation of Spinner, Ring Frame.

Table II shows the means, standard deviations, ranges, Pearson product-moment correlations with the criterion and the standard errors of correlation for age, education and experience for the sample of sixty Spinners, Ring Frame.

TABLE II

Means (M), Standard Deviations (σ), Ranges, Pearson Product-Moment Correlations With the Criterion (r), and the Standard Errors of Correlation (σ_r) for Age, Education, and Experience

Spinner, Ring Frame 682.885

N = 60

	M	σ	Range	r	σ_r
Age (years)	32.1	6.9	18-45	.007	.129
Education (years)	9.2	2.0	5-12	.061	.129
Experience (months)	101.8	69.2	8-307	.247	.122

The data in Table II indicate that there is no significant correlation between age, education or experience and the criterion. The sample does not appear to be particularly homogeneous with respect to any of these variables. Two of the 60 women in the sample had only a 5th grade education. However, since their GATB test scores appear to be comparable to the rest of the workers, they were included in the final sample.

III. Job Description

Job Title: Spinner, Ring Frame 682.885

Job Summary

Tends and keeps in constant operation a group of ring spinning machines (several hundred spinning units) which spin thread out of roving (cotton fiber). Replaces exhaust bobbins of roving in the creel, rapidly repairs ends of yarn that break in the machines, and frequently cleans lint and dust from parts of the machines.

Work Performed:

Inspects the machines: Walks around the machines watching their operation closely, in order to detect broken strands of roving, or yarn; to detect accumulation of lint on various parts of the machine (particularly the lap-stick as an indicator of broken yarn); and to note when a bobbin in the creel is running out of roving.

Creels the roving bobbins: Observes a bobbin nearly exhausted of roving; lifts the spent bobbin and skewer from the frame and lays the bobbin aside; picks up a full bobbin of roving from a stock on top of the machine, carefully selecting the proper bobbin for the spinning phase (makes such a determination by observing the color of the point visible on the ends of the bobbins); unreels the tail of the roving from the bobbin until the full-bodied portion of the roving is reached; manually fits the full bobbin of roving onto the skewers and replaces the skewer and bobbin in the frame; twists the tail of roving onto one of the ends feeding into the drafting unit of the machine, thus replacing the spent bobbin in the creel.

Pieces up ends: Observes the spinning units to determine if a break in the yarn has occurred; stops the rotating motion of the bobbin, if break in yarn has occurred, by pressing the thumb and forefinger of the left hand against the bottom of the live spindle; locates the broken end of the yarn on the bobbin and unreels some yarn from it with the right hand; threads the yarn through the pig-tail guide and pulls it down so that the end of the yarn is grasped in the palm of the left hand (that portion of the left hand not holding the live spindle); keeps the strand of yarn taut with the left hand while hooking it under the ring traveller with the fingers of the right hand (the yarn is forced down and under the ring traveller by pressing it down with the fingers at a point between the pig-tail guide and the bobbin); removes the left hand allowing the spindle to

rotate; breaks off the end of the yarn so that approximately one-half inch is protruding between the thumb and forefinger of the right hand; carefully aims the end of the yarn so that it becomes engaged with the other end of the broken yarn protruding through the drafting unit (immediately upon contact, the two strands of yarn automatically join together and are pieced up).

Cleans the machines: Performs the following cleaning duties in removing excess lint and dust from various parts of the machine.

Picks the boards: Manually lifts clearer board and removes lint from underside by rubbing off with hands and fingers; replaces board over an adjacent spinning unit.

Cleans rollers: Cleans the drafting units, exposed through the lifting of the clearer board, by rapidly moving a small hand brush back and forth between the rollers to remove the accumulated lint; returns clearer board to original position.

Cleans lap-stick: Manually lifts lap-stick from its position in the machine and slides it through the closed hands to remove the accumulated lap; stuffs the lap in apron pocket and replaces lap-stick in machine.

Brushes rings: Guides an L-shaped brush rapidly between the rotating bobbins to remove lint and dust from the ring bar extending the length of the machines (carefully avoids breaking the yarn on the bobbins with brushing movements).

Performs other less detailed or less frequent cleaning jobs such as removing lint from the top of the machines.

May stop the machines for doffing (removal of filled bobbins).

IV. Experimental Battery

All of the parts of the GATB, B-1002A, were administered to the sample group.

V. Criterion

The criterion at the Dixie Mercerizing Company, consisted of rank order supervisory ratings. The two shift foremen, who are the immediate supervisors of the 45 persons tested, each made separate ratings. The general foreman, who is the supervisor of the two shift foremen, and who is also in fairly frequent contact with the individual workers on the job, prepared additional ratings on these workers. The three sets of ratings were then pooled in a "give and take" discussion held by the general foreman and the two shift foremen. The pooled rank order ratings were converted to linear scores for computational purposes.

The criterion at the Hyde Park Mills consisted of rank order ratings made by the Personnel Director who had come to know the workers by actual observation on the job and through routine discussion with the immediate foremen of the workers. The rank order ratings were converted to linear scores.

Both sets of linear scores were combined into a single distribution for the entire sample of 60 Ring Spinners. The distribution of 60 linear scores was employed for the computation of pearson product-moment correlation coefficients with the distributions of aptitude scores, and was subsequently dichotomized to compute tetrachoric correlation coefficients and apply the Chi Square test to evaluate the test norms.

VI. Statistical and Qualitative Analysis

Table II shows the means, standard deviations, Pearson product-moment correlations with the criterion and the standard errors of correlation for the aptitudes of the GATB. The means and standard deviations of the aptitudes are comparable to general population norms with a mean of 100 and a standard deviation of 20.

TABLE III

Means (M), Standard Deviations (σ), Pearson Product-Moment Correlations with the Criterion (r), and Standard Errors of Correlation (σ_r) for the Aptitudes of the GATB

Spinner, Ring Frame 682.885

N = 60

Aptitudes	M	σ	r	σ_r
G-Intelligence	83.9	12.8	.095	.128
V-Verbal Aptitude	85.2	13.4	.120	.127
N-Numerical Aptitude	81.0	13.4	.139	.127
S-Spatial Aptitude	87.6	15.1	.038	.129
P-Form Perception	87.6	19.3	.020	.129
Q-Clerical Perception	91.1	13.3	.050	.129
K-Motor Coordination	94.0	16.0	.399**	.109
F-Finger Dexterity	90.9	16.3	.188	.125
M-Manual Dexterity	98.6	17.5	.379**	.111

**Significant at the .01 level.

The statistical results were interpreted in the light of the job analysis data. The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation.

P - Form Perception - needed in the inspection tasks of detecting broken strands and lint on parts of the machine as indications of malfunctioning of the spinning process.

K - Motor Coordination - involved in threading the ends of the yarn through the guide wire and ring traveller and piecing the ends of the broken yarn together; also in guiding the cleaning brush in brushing rings. Motor Coordination is necessary for the precise rapid hand movements in brushing operations and in replacing bobbins

F - Finger Dexterity - needed to grasp the strands of roving and to twist them in creeling, also in fingering the strand of yarn in the rather difficult and rapid task of piecing up ends.

M - Manual Dexterity - involved in handling and fitting bobbins in creeling; in manipulating bobbins and yarn in piecing up ends; and in removing and replacing various parts in the rapid and continuous cleaning operations.

The data in Table III indicate that the highest mean scores were obtained for Aptitudes M and K. All of the aptitudes have standard deviations of less than 20.

When N = 60, correlations of .331 and .255 are significant at the .01 and .05 levels of confidence, respectively. Aptitudes K and M correlate significantly with the criterion at the .01 level.

On the basis of job analysis data, high mean scores and significant correlations with the criterion, Aptitudes K and M were included in the test norms. Although Aptitude F does not show a statistically significant correlation with the criterion, it shows the fourth highest mean score for this sample and appears to be important for successful performance of the duties of this occupation on the basis of job analysis data. Therefore, Aptitude F was selected for inclusion in the test norms. Aptitude P was included in the norms on the basis of job analysis data and also because it increases the predictive value of norms which include Aptitudes K, F, and M.

The minimum scores for Aptitudes P, K and F were set at one standard deviation below the mean scores and rounded to the nearest five point score levels. The minimum score for Aptitude M was set at one standard deviation below the mean and rounded to the higher adjacent five point score level. Setting cutting scores at these levels yielded the best selective efficiency for the norms and resulted in critical scores of 70, 80, 75 and 80 for Aptitudes P, K, F, and M, respectively.

For the purpose of computing the tetrachoric correlation coefficient and Chi Square, the criterion was dichotomized so that those workers who were ranked in the lower one-third of each sample were placed in the low criterion group. Those workers who were ranked in the upper two-thirds of each sample were placed into the high criterion group.

Table IV shows the relationship between test norms consisting of Aptitudes P, K, F and M with critical scores of 70, 80, 75 and 80, respectively and the dichotomized criterion for Spinner, Ring Frame 682.885. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Relationship Between Test Norms Consisting of Aptitudes P, K, F, and M with Critical Scores of 70, 80, 75, and 85, Respectively and the Criterion for Spinner, Ring Frame 682.885

N = 60

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	9	31	40
Poor Workers	11	9	20
Total	20	40	60

r_{tet} = .52 X^2 = 4.959

σr_{tet} = .22 P/2 < .025

The data in the above table show a significant relationship between the norms and the criterion for this sample.

VII. Conclusions

On the basis of job analysis data, mean scores, correlations with the criterion and their combined predictive efficiency, Aptitudes P, K, F and M with minimum scores of 70, 80, 75 and 85, respectively, are recommended as B-1002 norms for the occupation of Spinner, Ring Frame 682.885. The equivalent B-1001 norms consist of P-70, T-75, F-80 and M-90.